Analysis of the Role of Investor Sentiment on Expected Returns Under CAPM Model Based on Behavioral Finance Perspective

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Abstract. In the financial market, the impact of investor sentiment on investment decisions is crucial and challenges the assumptions of classical financial theories. From the perspective of behavioral finance, this study constructs an investor sentiment indicator using monthly data of the Chinese A-share market from 2010 - 2023 as a sample and empirically analyzes it using a multiple linear regression model. Based on the CAPM model, this study further introduces control variables and interaction terms to explore the mechanism of investor sentiment on asset pricing. The empirical results show that irrational behavior triggered by investor sentiment interferes with asset pricing, and investor sentiment is significantly negatively related to expected return. Split-sample analysis further reveals that stock prices of small-capitalization firms are more significantly affected by sentiment, but large-capitalization firms will face a stronger negative impact. In addition, the negative effect of investor sentiment on expected returns is more pronounced in the case of lower institutional ownership, which may also be related to the difference in the stability of different market players under sentiment shocks.

Keywords: Investor sentiment; Expected return; Capital Asset Pricing Model(CAMP); Behavioral finance.

1 Introduction

In the actual operation of financial markets, the impact of investor sentiment on investment decisions has become increasingly significant. In recent years, global financial market volatility has intensified, for example, during the US stock meltdown in 2020, market panic spread rapidly, leading to large fluctuations in asset prices, which seriously deviated from the expectations of classical financial theory. Investors are not fully rational in their actual decision-making, and traditional financial models based on rationality assumptions face challenges in explaining market volatility. More and more studies have shown that investor sentiment can significantly affect asset pricing, further

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promoting behavioral finance's in-depth exploration of irrational factors in the market [1].

From the perspective of academic research development, the classical Capital Asset Pricing Model (CAPM), as the cornerstone of modern financial theory, has been widely used in asset pricing, portfolio management and other fields. However, with the rise of behavioral finance theory, relevant studies have begun to emerge that point out through prospect theory that investors have psychological biases such as overconfidence and loss aversion, which can lead to emotionally-driven investment decision-making behavior [2]. In recent years, scholars have explored the relationship between investor sentiment and asset pricing more deeply. Some studies have analyzed the generation and contagion mechanism of investor sentiment in depth by constructing an investor sentiment contagion model, which provides a new perspective for studying the impact of investor sentiment on asset pricing [3]. There are also studies that use machine learning and big data analysis methods to mine investor sentiment information in social media data, further enriching the way of measuring investor sentiment [4].

In the field of financial market research, the relationship between investor sentiment and expected return has been a hot topic. In recent years, some scholars have mined social media data to construct investor sentiment indicators with the help of machine learning algorithms and natural language processing technology [5], and some studies have constructed a composite investor sentiment index for the cryptocurrency market, which enriches the measurement, but the model stability and generality are poor and lack of uniform standards [6]. Some scholars use the threshold regression model to study the asymmetric impact of investor sentiment on stock returns in the Chinese stock market [7], and other related studies use the TVP - VAR model to explore the time-varying relationship between the two [8]. However, most of the existing studies focus on the linear relationship and do not explore the nonlinear relationship enough. Other scholars analyze the internal mechanism of investor sentiment affecting expected return from behavioral finance theory [9], and include information asymmetry factors to study its interaction with investor sentiment [10], but the research on the influence mechanism is still not in-depth.

Although studies have realized that investor sentiment can interfere with asset pricing, there is still a lack of in-depth and systematic research on the specific mechanism and direction of its impact on expected returns, and the differences in the impact of different market environments. In view of this, this paper centers on the impact of investor sentiment on expected returns to carry out in-depth research. An extended model incorporating investor sentiment indicators is constructed and empirically analyzed using monthly data from China's A-share market from 2010 to 2023. The methodology overcomes the limitations of investor sentiment measures in previous studies and the unmeasured differences in the impact of investor sentiment on different markets. Compared with previous studies, the innovations of this paper include.

(1) This paper adopts multiple indicators to measure investor sentiment comprehensively and accurately to reflect its changes.

(2) This paper examines the impact of different markets and industries in different samples to provide market participants with a more targeted basis for decision-making and improve the behavioral finance theory system.

2 Datasets and Methods

2.1 Description of the Data Set

In this paper, the panel data of Shanghai and Shenzhen A-share listed companies from 2010 to 2023 are selected as the research sample. The data sources include the CSMAR database and the WIND database. In order to ensure the accuracy and reliability of the data, this study firstly excludes the companies in the financial industry, as well as the companies that are ST and *ST during the sample period, then deletes the samples with missing values of the variables, and finally applies the upper and lower 1% shrinkage to the continuous type variables.

2.2 Data Analysis

Descriptive Statistical Analysis. This study carries out descriptive statistical analysis of relevant variables. As shown in Table 1, These statistical results provide the basis for subsequent analysis.

Table 1. Descriptive statistics.

variable name	Number of variables	average value	standard deviation	minimum value	maximum values
Fr_rf	338,347	-0.1546	0.1483	-0.9361	2.7983
Sentiment	345,935	0.0923	0.9897	-7.1455	6.6334
mkt_w	345,946	0.0054	0.0622	-0.2645	0.1941
smb_w	345,946	0.0023	0.0381	-0.1526	0.1560
vmg_w	345,946	0.0099	0.0322	-0.0704	0.1229
pmo_w	345,946	0.0067	0.0372	-0.1779	0.1669
Size	345,946	22.2227	1.2945	19.5268	26.4273
Lev	345,946	0.4206	0.2036	0.0253	0.9161
ROE	345,695	0.0740	0.1001	-0.3851	0.3163
Growth	345,856	0.1838	0.4414	-0.7486	5.9731
SOE	345,946	0.3694	0.4827	0.0000	1.0000
ListAge	345,946	2.1011	0.8685	0.0000	3.3673
INST	345,946	0.3905	0.2382	0.0002	0.8776

Correlation Analysis. As shown in Table 2, expected return (Fr_rf) exhibits a significant negative correlation with investor sentiment (Sentiment), with a correlation coefficient of -0.121 and significant at 1% level of significance. This result suggests that the higher the investor sentiment, the lower the expected return may instead be in the range covered by the sample data. This negative correlation implies that investor sentiment plays an important role in the process of asset pricing and return formation in the financial market, which may reflect the deviation of asset prices from their intrinsic values due to excessive optimism or pessimism of investors in the market, which in turn affects the expected return.

Table 2. Correlation analysis.

	Fr rf	Sentiment	mkt w	smb w	vmg w	pmo w	Size	Lev	ROE	Growth	SOE	ListAge	INST
Fr rf	1												
Sentiment	0.121***	1											
mkt w	0.099***	-0.131***	1										
smb w	-0.050***	-0.106***	0.229***	1									
vmg w	-0.033***	0.064***	-0.324***	-0.531***	1								
pmo w	-0.055***	-0.021***	-0.261***	0.278***	0.012***	1							
Size	0.047***	-0.067***	0.013***	-0.010***	0.004**	-0.001	1						
Lev	-0.009***	-0.017***	0.002	0.015***	-0.010***	0	0.517***	1					
ROE	0.016***	0.055***	-0.016***	-0.010***	0.012***	-0.004**	0.106***	-0.153***	1				
Growth	0.030***	0.014***	-0.021***	0.003	0.021***	0.011***	0.036***	0.039***	0.243***	1			
SOE	-0.056***	0.069***	-0.010***	0.021***	-0.008***	0	0.364***	0.311***	-0.054***	-0.052***	1		
ListAge	0.051***	-0.020***	0.023***	0.010***	-0.012***	-0.004**	0.416***	0.377***	-0.155***	-0.047***	0.445***	1	
INST	0.010***	0.047***	0.001	0.014***	-0.008***	0.001	0.460***	0.239***	0.125***	0.001	0.401***	0.384***	1

* p < 0.1, ** p < 0.05, *** p < 0.01

Endogeneity Test. The endogeneity test is conducted using a two-stage least squares approach, where the instrumental variable is the mean of the sentiment of the industry in which the firm operates, where the first one or two columns are the first stage and the third column is the second stage. This article differs from the rest of the articles by focusing on the interaction term Sentiment*mkt_w of Sentiment with the market risk factor, so the introduction of instrumental variables requires the introduction of two instrumental variables to go to one-to-one correspondence, respectively, i.e., the firm's Sentiment uses the mean of the industry's Sentiment as an instrumental variable.Sentiment*mkt_w uses the industry's Sentiment and the interaction term of the market risk factor, ISentiment* mkt_w, are used as instrumental variables. As shown in Table 3, the regression results of Sentiment*mkt_w in the third column remain significant, indicating that the higher the investor sentiment, the lower the expected return on the stock will be, and the endogeneity problem does not exist.

Table 3. Endogeneity test.

	(1)	(2)	(3)
	Sentiment	Sentiment* mkt_w	Fr_rf
ISentiment	0.9936***	-0.0051***	
	(350.5791)	(-30.7498)	
ISentiment* mkt_w	-1.7639***	1.0613***	
	(-36.9503)	(187.7370)	
mkt_w	-1.2358***	-0.0266***	0.1133***
	(-54.1572)	(-10.5509)	(8.5075)
smb_w	-2.2482***	-0.0552***	-0.5596***
	(-51.4529)	(-24.6455)	(-12.9092)
vmg_w	-0.5894***	0.0149***	-0.2353***
	(-11.3465)	(5.9729)	(-6.7155)
pmo_w	0.4814***	0.0212***	-0.0459**
	(12.6974)	(8.0867)	(-2.2172)
Size	-0.0323***	0.0001	-0.0005
	(-22.5986)	(1.3427)	(-0.3468)
Lev	-0.1529***	-0.0015***	-0.0138**
	(-15.0078)	(-2.5826)	(-2.2733)
ROE	0.0821**	0.0058**	-0.0015
	(2.0616)	(2.4582)	(-0.0779)
Growth	0.0027	0.0005***	0.0117***
	(0.8657)	(2.9688)	(7.5200)
SOE	0.0082**	-0.0013***	-0.0145***
	(2.3896)	(-6.3854)	(-7.2599)
ListAge	0.0414***	-0.0000	0.0122***
	(20.6687)	(-0.2926)	(8.6168)
INST	0.1994***	0.0023***	0.0203***
	(26.9847)	(5.4530)	(3.7848)
Sentiment			-0.0757***
			(-15.0627)
Sentiment*mkt_w			-0.4586***
			(-15.0017)
_cons	0.5984***	-0.0085***	-0.1660***
	(20.4163)	(-5.0075)	(-5.2061)
r2	0.3008	0.3023	.
N	345594	345594	338022

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

2.3 The Construction of Investor Sentiment

Investor sentiment essentially stems from the psychological activities of investors, and is a psychological state produced by investors when carrying out investment transactions in the financial market. However, until now, there is no uniform and authoritative

definition of investor sentiment in the academic world. In order to measure the sentiment index of small and medium-sized investors more effectively, on the basis of comprehensive reference to previous literature research, this paper decided to start from the annual stock bar posts that can reflect the emotional tendency of the comment posts, combined with the monthly net retail fund inflow to construct the investor sentiment index by principal component analysis. Firstly, calculated the positive posting ratio, positive posting ratio = positive posting/total number of posts, then calculated the monthly frequency of net retail fund inflow at the company level, which was obtained from WIND database, and finally, used the principal component analysis to take the first principal component as the positive investor sentiment indicator.

2.4 Model Construction and Analysis

A multiple linear regression model is constructed, incorporating the ideas of the Capital Asset Pricing Model (CAPM) with several control variables and interaction terms to analyze the factors affecting the expected rate of return.

Specific model construction:

$$\begin{aligned} Fr_{rf_i} = \beta_0 + \beta_1 Sentiment_i + \beta_2 mkt_{w_i} + \\ \beta_3\left(Sentiment_i * mkt_{w_i}\right) + \beta_4 smb_{w_i} + \beta_5 vmg_{w_i} \\ +\beta_6 pmo_{w_i} + \beta_7 Size_i + \beta_8 Lev_i + \beta_9 ROE_i + \beta_{10} Growth_i \\ +\beta_{11} SOE_i + \beta_{12} ListAge_i + \beta_{13} INST_i + \epsilon_i \end{aligned} \quad (1)$$

where expected return (Fr_rf), investor sentiment (Sentiment), market factor (mkt_w), size factor (smb_w), value factor (vmg_w), sentiment factor (pmo_w), firm size (Size), leverage (Lev), return on net income (ROE), growth rate of operating income (Growth), growth rate of Nature of Ownership (SOE), Years on Market (ListAge), Institutional Ownership (INST), Interaction Term between Capitalist Sentiment and Market Factors (Sentiment * mkt_w (later simplified as a)), ϵ_i (Error Value).

In this study, the Ordinary Least Squares (OLS) method is used to estimate the parameters of equation (1). In order to deal with the possible problem of heteroskedasticity and ensure the robustness of the estimation results, robust standard errors are used in the regression process. Through this method, the regression coefficients of the explanatory variables can be estimated more accurately to determine the direction and degree of their impact on the expected return, providing a reliable basis for the subsequent analysis and conclusions.

3 Findings

3.1 Multiple Linear Regression Results

This study utilizes a multiple linear regression model to provide insights into the role of various factors on the expected return (Fr_rf), among which the impact of investor sentiment on the expected return is of great interest.

As shown in Table 4, the regression coefficient of investor sentiment (Sentiment) is -0.0160 and highly statistically significant (t-value of -61.9716), which clearly shows that there is a significant negative relationship between investor sentiment and expected return. That is to say, the higher the sentiment, the lower the expected return. In the real market, investors are not completely rational, and high sentiment may lead to the overvaluation of assets, causing prices to deviate from their intrinsic value. When the market returns to rationality, prices converge to the true value and expected returns decline accordingly.

In addition, the coefficient of the interaction term between investor sentiment and the market factor (Sentiment * mkt_w) is -0.1262, which is also highly significant (t-value of -27.5351). This result suggests that investor sentiment does not affect expected returns in isolation, but rather moderates the relationship between market factors and expected returns. Specifically, the negative impact of market factor changes on expected returns intensifies under high investor sentiment, as increased market homogeneity and volatility amplify these effects. For instance, during a downturn, heightened panic further exacerbates the decline in expected returns.

Overall, investor sentiment not only has a significant negative impact on expected returns, but also has a more complex impact on expected returns through the interaction with market factors, which provides important clues for understanding the formation mechanism of expected returns in financial markets.

Table 4. Results of multiple linear regression.

	(1) Fr_rf
Sentiment	-0.0160***
	(-61.9716)
mkt_w	0.2141***
	(42.4283)
a	-0.1262***
	(-27.5351)
smb_w	-0.4302***
	(-45.2044)
vmg_w	-0.2518***
	(-24.9429)
pmo_w	-0.0085
	(-1.0548)
Size	0.0061***
	(24.2666)
Lev	-0.0191***
	(-10.4431)
ROE	-0.0648***
	(-8.4478)
Growth	0.0105***
	(16.7518)

SOE	-0.0267***
	(-44.7484)
ListAge	0.0145***
	(39.2531)
INST	0.0017
	(1.3558)
_cons	-0.3053***
	(-59.4315)
r2	0.0450
N	338022

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

3.2 Robustness Check

To ensure the reliability and stability of the main regression results, this study conducts a robustness test. The lagged term of investor sentiment (L.Sentiment) is included in the test, and its coefficient is -0.0131 (t = -51.3136, p < 0.01) as can be seen in Table 5. It indicates that investor sentiment is significantly negatively correlated with expected return (Fr_rf) even if there is a lagged effect, echoing the findings of the main regression and reflecting the persistence of its negative impact. The sign and significance of the coefficients of the market factor (mkt_w), scale factor (smb_w), value factor (vmg_w) and other variables are basically consistent with the main regression, such as the coefficient of the market factor of 0.2553 (t = 49.7056, p < 0.01), which highlights the stability of the market's positive role in promoting the market; the scale and value factors are significantly negative, which confirms their negative relationship with expected returns Stability. The direction and significance of the correlation between company fundamentals-related variables, such as company size (Size) and expected return, are also consistent with the main regression, highlighting the stability of the influence of fundamentals. The r^2 of the robustness test model is 0.0419 and the sample size N is 330510, which is still statistically significant despite the changes. In conclusion, the robustness test supports the reliability of the main regression results, that is, the influence of investor sentiment and other factors on expected returns is stable and persistent.

Table 5. Robustness Tests - Dependent Variable Investor Sentiment Lagged by One Period.

	(1)
	Fr_rf
L.Sentiment	-0.0131***
	(-51.3136)
mkt_w	0.2553***
	(49.7056)
b	-0.0756***
	(-15.9968)
smb_w	-0.4025***

	(-42.0975)
vmg_w	-0.2298***
	(-22.7285)
pmo_w	-0.0003
	(-0.0341)
Size	0.0068***
	(26.6882)
Lev	-0.0211***
	(-11.3944)
ROE	-0.0715***
	(-9.1932)
Growth	0.0102***
	(15.9679)
SOE	-0.0278***
	(-46.1098)
ListAge	0.0145***
	(38.9446)
INST	0.0003
	(0.1996)
_cons	-0.3180***
	(-61.3544)
r2	0.0419
N	330510

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

3.3 Heterogeneity Analysis

Grouped by Company Size: In order to examine whether the effect of investor sentiment on expected returns varies by firm size, this study conducts regression analyses by dividing the sample into small-capitalization group (1) and large-capitalization group (2) based on the market capitalization of the firms. As shown in Table 6, the coefficient of the interaction term between investor sentiment and market factor (Sentiment * mkt_w) is -0.1339 (t = -20.7108) in the small-cap group and -0.1214 (t = -18.9680) in the large-cap group, which are both significantly negative and the coefficient of the small-cap group is smaller in absolute value, suggesting that the phenomenon of the decrease in the expected rate of stock return when investor sentiment is high is more significant in the small-cap group.

The coefficient of investor sentiment (Sentiment) is -0.0138 (t = -38.2252) in the small-cap group and -0.0168 (t = -45.6933) in the large-cap group, both of which are significantly negatively correlated, and the degree of negative influence is greater in the large-cap group, probably because large-cap companies are subjected to a high degree of market attention, and the influence of the sentiment is more extensive. In addition, the sign and significance of the coefficients of variables such as market factor (mkt_w), size factor (smb_w), value factor (vmg_w), and company fundamentals differ

in different market capitalization groups, e.g., the leverage ratio (Lev) influences the expected returns of the two groups in opposite directions. The model r^2 of small and large market capitalization group is 0.0483 and 0.0548 respectively, and the sample sizes are 168267 and 169755 respectively, and the large market capitalization group has a better fit. It can be seen that the influence of investor sentiment and other variables on expected returns varies according to the size of the company's market capitalization, which provides a new perspective for understanding the formation mechanism of expected returns.

Table 6. Heterogeneity test: grouping by firm size.

	(1)	(2)
	Fr_rf	Fr_rf
Sentiment	-0.0138***	-0.0168***
	(-38.2252)	(-45.6933)
mkt_w	0.2378***	0.1836***
	(30.6276)	(28.5721)
a	-0.1339***	-0.1214***
	(-20.7108)	(-18.9680)
smb_w	-0.5061***	-0.3353***
	(-34.8492)	(-27.3718)
vmg_w	-0.3738***	-0.1286***
	(-24.6247)	(-9.7046)
pmo_w	-0.0107	-0.0133
	(-0.8673)	(-1.2859)
Size	0.0229***	0.0119***
	(32.4574)	(32.2865)
Lev	0.0061**	-0.0349***
	(2.3631)	(-13.1016)
ROE	-0.0399***	-0.0615***
	(-3.2305)	(-6.0471)
Growth	0.0099***	0.0110***
	(9.7049)	(13.8858)
SOE	-0.0246***	-0.0268***
	(-24.5552)	(-36.2659)
ListAge	0.0127***	0.0177***
	(23.8751)	(33.5498)
INST	-0.0014	0.0074***
	(-0.7505)	(4.3881)
_cons	-0.6607***	-0.4508***
	(-44.6863)	(-55.3791)
r2	0.0483	0.0548
N	168267	169755

t statistics in parentheses

* p < 0.1, ** p < 0.05, *** p < 0.01

Grouped by Institutional Shareholding. In order to clarify how the difference in the level of institutional investor ownership affects the role of investor sentiment on expected returns, this study divides the sample into a low institutional investor group (1) and a high institutional investor group (2) based on the percentage of institutional investor ownership and regresses them separately. The results, as shown in Table 7, show that investor sentiment has a significant negative effect on expected return (Fr_rf) in both groups, and the absolute value of the coefficient of the low institutional investor group is larger than that of the high institutional investor group, which suggests that the negative effect of investor sentiment is stronger in the low-institutional investor environment. role is stronger. The interaction term (a) is significantly negative in both groups, and the coefficient of the low institutional investor group has a deeper effect. The market factor (mkt_w) is significantly positive in both groups, with the coefficient of the high institutional investor group having a relatively stronger contribution; the coefficients of the size factor (smb_w) and the value factor (vmg_w) are significantly negative in both groups, with the low institutional investor group having a larger absolute value. The model (r^2)_ is 0.0475 (N = 168497) for the low institutional investor group and 0.0446 (N = 169525) for the high institutional investor group, with the former having a slightly better fit. This may be due to the fact that institutional investors have more professional analytical ability and more rational investment strategies, which can stabilize the stock price to a certain extent and reduce the impact of sentiment on the stock price. When the proportion of institutional shareholding is low, this stabilizing effect is weakened and the negative impact of sentiment becomes more prominent. It can be seen that the level of institutional investors' shareholding significantly affects the role of investor sentiment and other factors on expected return, which provides a new perspective for understanding the formation mechanism of expected return, as well as a reference for investment decision-making and market regulation.

Table 7. Heterogeneity test: grouping by institutional shareholdings.

	(1) Fr_rf	(2) Fr_rf
Sentiment	-0.0175***	-0.0143***
	(-46.5895)	(-40.3081)
mkt_w	0.2181***	0.2086***
	(28.9289)	(31.1211)
a	-0.1372***	-0.1155***
	(-21.1737)	(-17.8767)
smb_w	-0.5179***	-0.3372***
	(-36.6882)	(-26.4056)
vmg_w	-0.3324***	-0.1699***
	(-22.3829)	(-12.4342)
pmo_w	0.0086	-0.0263**
	(0.7120)	(-2.4595)
Size	0.0033***	0.0084***
	(7.7269)	(26.1513)

Lev	0.0021	-0.0437***
	(0.8176)	(-16.2765)
ROE	-0.0659***	-0.0473***
	(-5.8688)	(-4.4448)
Growth	0.0100***	0.0113***
	(11.0820)	(12.8670)
SOE	-0.0327***	-0.0241***
	(-32.9021)	(-31.9593)
ListAge	0.0145***	0.0147***
	(27.8533)	(26.2830)
INST	0.0091***	-0.0128***
	(2.7826)	(-4.4500)
_cons	-0.2542***	-0.3384***
	(-28.9126)	(-52.8453)
r2	0.0475	0.0446
N	168497	169525

t statistics in parentheses
* p < 0.1, ** p < 0.05, *** p < 0.01

4 Conclusions

In this study, a model is constructed to analyze the impact of investor sentiment on expected returns with the help of monthly data of China's A-share market from 2010 to 2023. The results show that the two are significantly negatively correlated, and the higher the investor sentiment, the lower the expected return, because the irrational behavior triggered by sentiment interferes with asset pricing. Moreover, investor sentiment moderates the impact of market factors on expected returns, and the negative impact of market factor changes on expected returns is exacerbated when sentiment is high.

The sub-sample study finds that the impact varies across firm size and institutional ownership. Small-capitalization firms' stock prices are more prominently affected by investor sentiment, and expected returns decline more significantly when sentiment is high; large-capitalization firms are negatively affected by sentiment to a greater extent. The negative effect of investor sentiment on expected return is stronger in a low institutional ownership environment.

By constructing an extended model, this study clarifies the negative relationship between investor sentiment and expected return as well as its interaction with market factors, which provides a new theoretical perspective for understanding the formation mechanism of expected return in the financial market and helps to improve the behavioral finance theoretical system. Investors can adjust their investment strategies according to the investor sentiment indicators to avoid blindly following the wind when the sentiment is overheated and reduce the investment risk. However, there are shortcomings in the study, such as the lack of perfection in the sentiment metrics, the possible omission of important factors in the model, and the limited sample scope. Follow-up

studies can improve on these aspects and dig deeper into the formation mechanism of expected returns in financial markets.

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